Analysis of experimental grain scale data in a crystal plasticity framework

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Three-dimensional X-ray diffraction microscopy (3DXRD) has been employed to investigate the behaviour of individual grains deeply embedded in the bulk of interstitial-free (bcc) and austenitic stainless (fcc) steels during tensile deformation. Three-dimensional grain maps have been constructed, meaning that each individual grain is characterised with respect to crystallographic orientation, size and shape. The behaviour of selected individual grains is characterised and their lattice rotations and developing orientation spread are analysed in terms of slip systems by means of crystal plasticity. The differences between individual grains of initially similar orientation will be analysed in relation to their environment of neighbouring grains. The goal is to identify the interaction mechanisms and employ these in prediction of the behaviour of individual grains.